

## ***Shewanella oneidensis* and the dissolution of calcite at neutral pH**

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We have studied the effect of microbial attachment on the dissolution kinetics of calcite using vertical scanning interferometry. Lüttge and Lasaga (2001) have previously used this technique to study the dissolution kinetics of calcite, dolomite and feldspar. The introduction of an internal reference allows us to quantify reaction progress over time. The organism *Shewanella oneidensis* was cultured under aerobic conditions and applied to a fresh surface of a calcite crystal exposed by cleavage along a (10-14) face. The mirror-equivalent plane of the cleaved crystal was exposed to the growth medium only, a 10 percent LB broth with added 10 mM Na lactate at neutral pH.

After 20 minutes, the control crystal exhibited a large number of etch pits, whereas the formation of etch pits was almost entirely inhibited by the microbes on the crystal with the *Shewanella*, and the rare etch pits present were quite shallow compared with those developed on the control crystal.

The microbes quickly (<20 min) settled on the crystal surface creating negative features, as though moving into the crystal. They formed chains and, ultimately, networks as they attached to the crystal, appearing to control dissolution of the calcite, a very different behavior than the dissolution of the control crystal. At 45 min, dissolution pits were ubiquitous and coalescing with each other on the control crystal, whereas the attachment of the microbial biomass still almost totally prevented formation of these etch pits. By 90 min., the crystal surface was almost entirely covered with a mat-like film of organisms and exo-polysaccharide filaments. Etch pits were shallow and undeveloped with respect to those that formed and coalesced on the control surface.

These preliminary results imply that *Shewanella* is able to detect the high energy sites at the mineral surface, i.e., the outcrops of dislocations, settle and take control over the dissolution process. Moreover, such results further imply that microbes might play a significant role in the stabilization of carbonates under conditions that might otherwise favor their dissolution.